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ABSTRACT

Children's attention to and comprehension of television programs were studied by comparing the effects of viewing continuous stories (i.e., those with meaningful plots brought to resolution) and magazine-format programs containing unrelated bits of entertainment. Effects of program pacing were also studied. Multiple programs, differing in content, were developed for each of four design cells (high/low pace by high/low continuity). Participants were 160 children divided into two age groups (kindergarten/first and third/fourth grades). Visual fixation of the television monitor was recorded during viewing of two programs in same-sex pairs, and children were then tested individually for comprehension and recall of both programs, using a non-verbal procedure requiring the child to order five still photographs from the program and five from a single segment. Control scores were obtained by having children order photos from one program which they had not viewed. Results indicated that the integrated stories can be effectively used to promote both attention and comprehension at an early age, because children clearly responded to and used the organizational structure provided by television stories even when the stories were low pace. Twelve references, and tables showing study design and attention and comprehension data are included. (LMM)

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The Information Processing Demands of Television and "Media Literacy" in Young Viewers

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Over the past several years, we have been developing a conception of children's active processing of broadcast television in relation to the formats, message structures, and audio-visual production features that characterize the favorite medium of the media generation. We have been more concerned with how children master and respond to the forms and codes of television than with the effects of its content, however trivial, pernicious, prosocial or educational it may be. We believe that the issues we are addressing as developmental psychologists are responsive to the critical questions raised two decades ago by Marshall McLuhan, and we sense a convergence between our ideas on how electronic media provide generalizable ways for children to encode and process information and the recent advances in understanding how children construct an understanding of connected discourse, texts, and scripts.

To begin with, I must cite a familiar statistic, but one which educational and developmental psychologists have neither taken seriously nor come to grips with: children from three to eleven years old in America spend more time watching television than in any other waking activity. During all that time, children are actively learning -- not only the content of the medium's messages, but also a set of information processing skills that are related to, but distinct from those involved in the consumption of other media. The emerging package of skills can be used to master video games and the vast wasteland of trivial or objectionable broadcast content, but they can also be used to develop a sense of excitement and competence in the use of computers and an appreciation of our history, culture, and

science from educational television's magnificent portrayals of sensory reality and fantasy across wide domains of time and space.

Morecver, American children's experience with, and store of, story scripts is primarily based on television stories. They spend more time learning TV stories than stories they hear from adults or from radio or records, or stories they see in movies or read in books. The story scripts and schemas derived from television viewing are framed by the unique combination of representational codes employed by television and referred to by Salomon (1979) as its symbol system. Language and verbal representation of course are an important part, but only a part, of television's symbol system. Yet not only have those who study children's understanding of discourse focused almost exclusively on verbal material, but they have also explicitly dismissed any possible role that the language of television might play in the development of children's information processing skills (Rice & Wartella, 1981; Rice, Huston & Wright, in press; Clark and Clark, 1977).

Recent advances in understanding of schematic processing as distinct from rote or categorical processing (Mandler, 1979) are of special interest to those who study children's processing of television. Understanding television is inherently a matter of processing connected, time-locked event structures and narratives. Schematic processing involves a child's comprehension and temporal integration of sequences of events (Collins, in press). The ability to parse the events of a TV portrayal into functional units and to appropriately connect events separated in time is critical to the logical comprehen-

sion of television. Such skills doubtless develop as a function of both cognitive maturation and TV viewing experience. Collins' data (Collins, Wellman, Keniston & Westby, 1978) suggest that children under eight or nine years of age cannot achieve logico-temporal integration of televised stories, but his data are based on studies using adult programs. Anderson, Lorch, Field and Sanders (1981) have demonstrated that children visually attend to, and attempt to process material that is produced in ways that signal its appropriateness and comprehensibility to children, but are turned off when that promise is not kept. In the same vein Salomon (1981) has argued that when children take television seriously, their comprehension is enhanced by an increased investment of mental effort in the task.

Connected narratives, or story formats, both demand effort to achieve temporal integration of their plots, and offer the child an opportunity to exercise existing schemes and scripts from her real-world or television knowledge base to help her prestructure, anticipate, and organize content into a coherent tale. An alternative type of programming that is gaining popularity in commercial television for both adults and children is the magazine format. A magazine program is a collection of separate bits that are not schematically related and would make equal sense presented in any order. This format makes far fewer demands on the viewer and offers less thematic continuity. Where a connected story both demands and benefits from schematic processing, a magazine-format program elicits discrete coding of bits, each consumed, like a cartoon in the New Yorker, for its self-contained amusement, but not integrated into a larger

meaningful message.

I wish to present the results of a recent study that assessed children's attention to, and comprehension of, programs based on story vs. magazine formats. Continuous stories with meaningful plots brought to resolution were compared with magazine format programs containing unrelated bits of entertainment.

The second major variable of interest was pace. As we have used the term in several studies of formal features, pace is defined as the rate of scene and character changes. Scenes (in a story) or "bits" (in a magazine) are marked by clear changes of time, place, and/or cast of characters. Pace is an inherent confound of rate of change and average chunk size. Longer bits have more internal coherence and involve less frequent shifts of context. But shorter chunks provide more novelty and variety. Allegedly shorter bits and scenes have more appeal, especially to younger viewers, on the grounds that their attention span is shorter. While the production styles involving a confound of high pace and the jazzy special effects of electronic embellishment have been criticized as superficial and suppressive of intelligent processing (Singer & Singer, in press), no previous studies have separated pace from "hype", or pace from continuity of format.

We have been especially interested in pace for another reason. In the recent literature it has two possible effects on children's attention and comprehension. On the one hand, high pace provides change, novelty, excitement, and in general that perceptual salience that has been shown to be one determinant of children's attention

(Huston & Wright, in press). If, however, the format is a continuous story and the child is capable of the investment of mental effort and skill needed to understand it, then a low-paced program might be more comprehensible and thus more attention-worthy than a high-paced program. In addition, of course, comprehension and recall scores should be better for low than for high paced programs in any format. Low paced programs are easier to follow, because they contain fewer changes of context per unit time. The perceptual salience of high pace should enhance attention, particularly for young viewers. By contrast, the greater comprehensibility of low pace programs should increase attention. Moreover, the older children should visually attend to whole scenes, taking their attentional breaks at scene-change boundaries, rather than in the middle of scenes, because they are familiar with the syntax and conventions of the medium. This effect should be especially prevalent when they are viewing stories, and would be apparent if the mean duration per look varied as a function of scene length -- i.e., low paced stories should elicit longer looks than high paced stories.

In order to claim generality of effects of pace and continuity on attention and comprehension, we felt it necessary to construct multiple programs differing in content in each of the four cells of the design: high/low pace by high/low continuity. Accordingly, from our library of 150 children's programs we constructed four different programs, two animated and two live, in each cell for a total of 16 programs. The four programs in each cell were selected and edited so as to be matched in continuity (story or magazine format) and in pace

(mean rate of scene or bit and character change).

Method

Participants were 160 children, equally divided into two age groups (kindergarten-first vs. third-fourth grades). Twenty older and twenty younger children were assigned to each pace x continuity condition. Children viewed in same-sex pairs and each pair saw two programs from the same treatment cell, one program animated and the other live. Toys and drawing materials were available in the viewing room as distractors. Each child's visual fixation of the monitor was continuously and independently recorded on a Datamyte, with better than 95% agreement between independent scorings of the same child. The two programs were shown with only a brief break in between. The children were then tested individually for comprehension and recall of both programs, the second program being tested first. This was done so that primacy and recency effects could be detected, for they are characteristic of rote and categorical, but not of schematic processing (Mandler, 1979).

The comprehension/recall procedure, deliberately a non-verbal one, required the child to seriate still photos taken from the programs. That is, each child was asked to arrange five photos to show the order in which they occurred in the program. One set of stills for each program represented the entire program. In story format programs they were taken from different scenes throughout the program; in magazine format shows they were taken from different bits throughout the program. The resulting scores are referred to as

"whole program" seriation scores. A second seriation task for each program required the child to order five stills taken from within a single segment of the program. In story programs they were taken from a single scene; in magazine shows, they came from a single bit. The resulting scores are called "segment" seriation scores. Each child was also asked to complete whole program and segment seriation tasks with photos taken from one program not shown, to generate control scores for each seriation task. Means have been adjusted for control scores on each seriation task. The "blind" score of children who had not seen the program but guessed at the seriation of photos was the covariate.

Results

Figure 1 shows two different indices of visual attention to the television programs. The solid bars (left ordinate) indicate total looking time, that is, the mean percent of the program that was visually attended to. The striped bars (right ordinate) represent mean duration per look in log of hundredths of minutes. This measure indexes the size of chunks of information attended to, rather that the overall percent of the program viewed. Age and continuity had significant main effects on total looking time. Overall, stories received more attention than magazine shows, and older children looked more of the time than did younger children. Furthermore, there was a different age pattern of attending to stories than is characteristic of magazine format programs. Specifically, the younger children attended more consistently to high than to low-paced programs, espe-

cially magazine-format shows. We interpret this diference as evidence that younger children are likely to look more at programs characterized by change, variety, and novelty (high pace), when such programs do not have continuous content to be integrated. The effect of pace is negligible in story programs.

Now we turn to duration per look. The age x pace interaction was significant for duration per look. For older subjects, duration per look was greater for low-paced than for high paced stories. This suggests that they were matching their looking to the length of scenes in a story, but not in a magazine-format show. Younger children did not show that pattern. Taken together, these findings are consistent with our dual hypothesis: a) that in continuous stories the age trend is toward coordinating attention to the schematic units of the narrative; and b) that in magazine-format programs, the age trend is away from attentional focus on perceptually exciting characteristics.

The comprehension data are shown in Figure 2. The main effects of age, pace, and continuity were significant for both whole-program and segment seriation scores. The pace x continuity interaction and the pace x continuity x age effects were significant or nearly so for both variables. It appears not surprisingly that story continuity demands and supports better sequential recall than magazine format. Moreover, it seems that continuity makes story sequencing less affected by pace than magazine sequencing. The latter is severely limited by high pace and/or the correspondingly larger number of unrelated bits to be recalled that high-paced magazine programs contain. Whole-program and segment seriation do not differ sharply in their

sensitivity to these comprehension effects.

However, for segment seriation only there was an effect of order. You recall that the program seen last was assessed for recall first. Superiority of recall of last over first program seen can be termed a recency effect, and it was not found for any of the story-format programs. It was, however, found for magazine-format shows. The significance of this recency effect and its appearance only in magazine-format seriation tasks at both ages is that, given a reasonably difficult processing task for which no schemes are available, processing and recall resemble verbal recall data from rote learning studies. They indicate non-schematic processing. However, when a schema is available, as it is in story-format programs, the recall data resemble those obtained from studies of the verbal processing of texts and narratives, processing that consistently fails to show recency effects. The absence of any recency effect in story processing, even among the high-paced stories for younger children, is a strong, though not yet conclusive bit of evidence that they can process televised narratives schematically and recall the logico-temporal sequence even after a delay with an intervening recall task.

We submit that the child brings to bear on her processing of televised material many of the same schemes and skills that characterize her processing of other narratives. But the reverse is also probably true: children apply TV-based schemas to the job of processing real world experience. Further, it appears from a comparison of the attention and comprehension effects of pace of magazine-format shows for younger children that in the absence of con-

tinuity and the schematic processing it facilitates, the same high pace that makes a program more superficially attention-worthy for its perceptual salience, also makes it less likely to be sequentially integrated and serially recalled. Although one might argue that sequencing is not an adequate test of comprehension in a magazine format, other indices of comprehension often covary with seriation.

The implications of these findings for production of effective educational and prosocial TV are that integrated stories can be effectively used to promote both attention and comprehension at an early age. Children clearly respond to and use the organizational structure provided by stories on TV, even when the stories are low pace. We suggest that television provides an important source from which children learn to construct stories and schemas. They learn to represent these schemas not only in verbal form, but also in the medium-specific codes and symbol systems of television.

It appears to us that a non-elitist view of children's learning and thinking should now begin to consider some of the productive consequences of the time children spend with their favorite medium, and how to optimize, rather than just minimize those close encounters.

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development. San Francisco: Jossey-Bass, 1981.

Table 1. Design of the Study

PACE	CONTINUITY: LOW (Magazine Format) — Live	LOW (Magazine Format) — Animated	HIGH (Story Format) — Live	HIGH (Story Format) — Animated
High	PROGRAM 1	PROGRAM 3	PROGRAM 9 *	PROGRAM 11 *
High	PROGRAM 2	PROGRAM 4	PROGRAM 10 *	PROGRAM 12 *
Low	PROGRAM 5	PROGRAM 7	PROGRAM 13	PROGRAM 15
Low	PROGRAM 6	PROGRAM 8	PROGRAM 14	PROGRAM 16

* Subject Assignment Example: In the High-Pace / High Continuity Condition, half of the subjects saw program 9, then program 11 (or 11, then 9). The other half saw program 10, then program 12 (or 12, then 10).

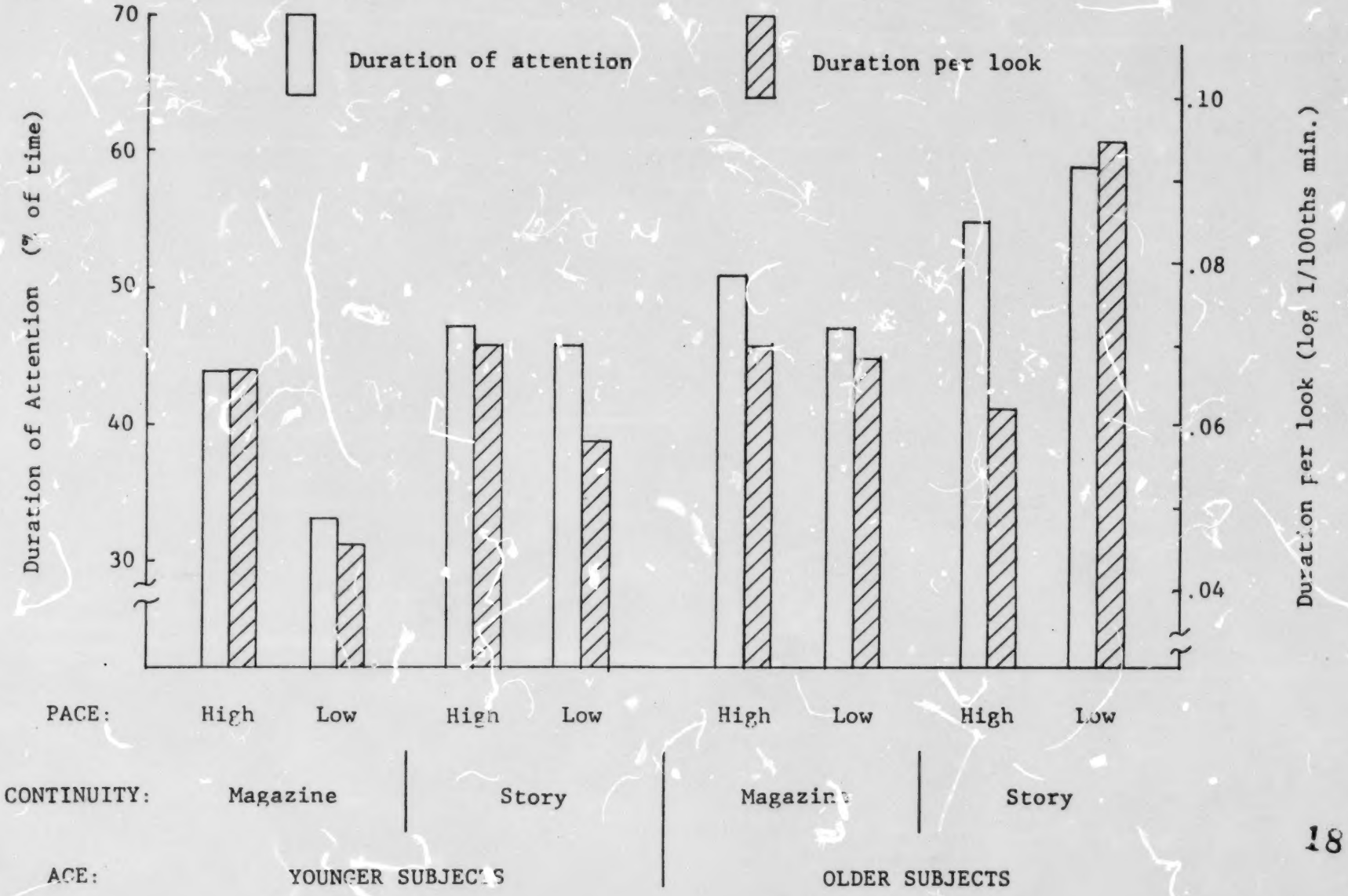

Figure 1. Attention Data

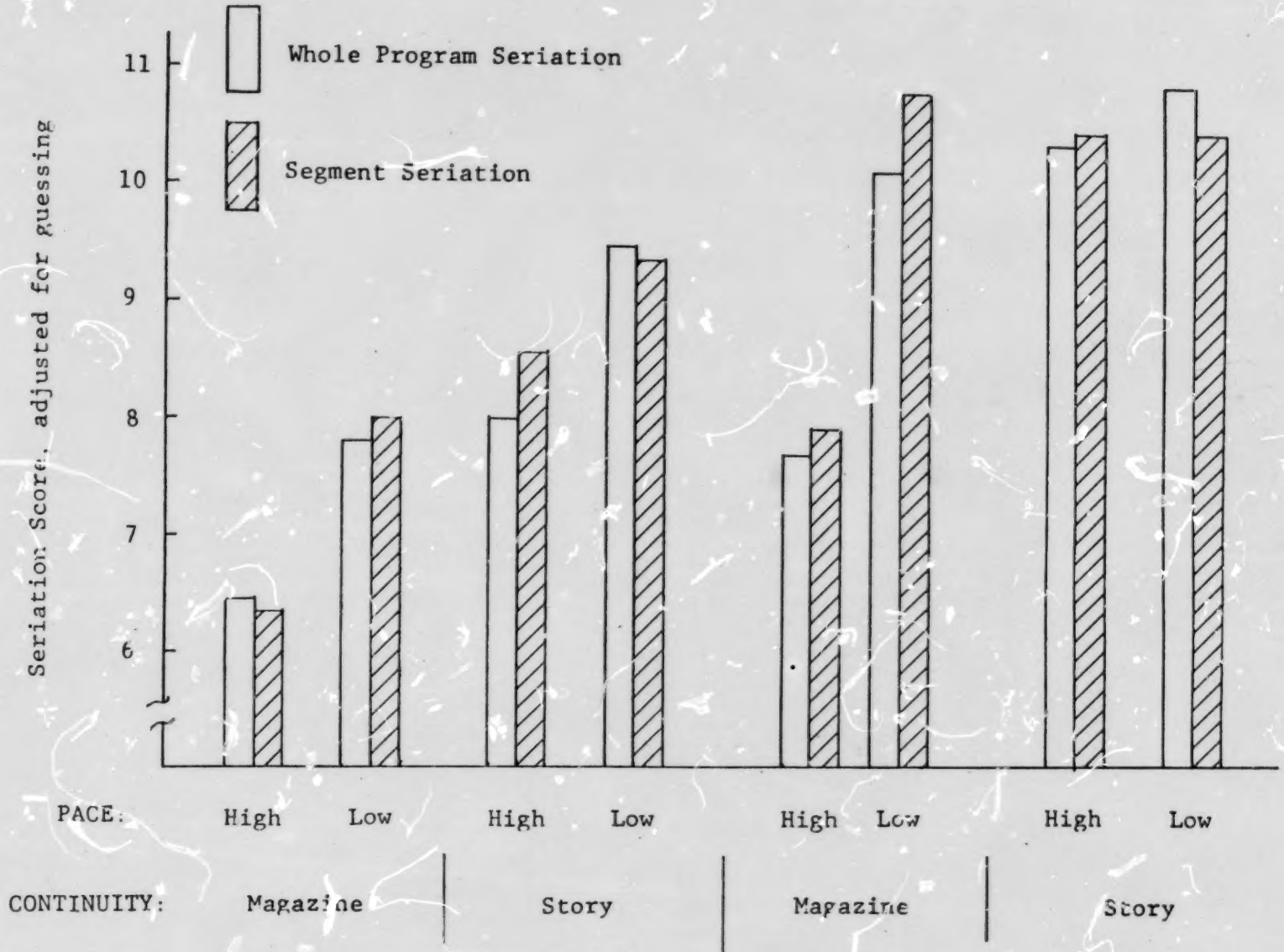

Figure 2. Comprehension Data